3.12 NOISE

This section describes existing noise conditions in the KVWPP area and surrounding area. It also identifies potential impacts and mitigation measures designed to limit those impacts. The analysis in this section is primarily based on information provided by the Applicant in the ASC (Sagebrush Power Partners LLC 2003a, Section 4.1.1). Where additional information has been used to evaluate the potential impacts associated with the proposal, that information has been referenced.

3.12.1 Affected Environment

Fundamentals of Acoustics

Sound travels through the air as waves of air pressure fluctuations caused by vibration. Because energy contained in a sound wave is spread over an increasing area as it travels away from the source, loudness decreases with distance. Noise is defined as unwanted sound. There are several ways to measure noise, depending on the source of the noise, the receiver, and the reason for the noise measurement.

A decibel (dB) is the unit used to describe the amplitude of sound. Noise levels are stated in terms of decibels on the A-weighted scale (dBA). This scale reflects the response of the human ear by filtering out some of the noise in the low- and high-frequency ranges that the ear does not detect well. The A-weighted scale is used in most noise ordinances and standards. The equivalent sound pressure level (L_{eq}) is defined as the average noise level for a stated period of time (such as hourly).

The dBA scale is logarithmic. Therefore, individual dBA ratings for different sources cannot be added directly to calculate the sound level for combined sources. For example, two sources, each producing 50 dBA will, when added logarithmically, produce a combined noise level of 53 dBA.

Noise Standards

There are two kinds of noise standards—absolute and relative. An absolute standard is a noise level that should not be exceeded, while a relative standard specifies the permissible increase in noise levels above background noise levels. The Washington State noise regulations specify absolute standards.

Section 173-60 of the WAC provides the applicable noise standards for Washington State, including Kittitas County. Kittitas County has not adopted independent state-approved noise standards pursuant to WAC 173-60-110. WAC 173-60 establishes maximum permissible environmental noise levels. These levels are based on the environmental designation for noise abatement (EDNA), which is defined as an area or zone (environment) within which maximum permissible noise levels are established. There are three EDNA designations (WAC 173-60-030), which generally correspond to residential, commercial/recreational, and industrial/agricultural uses:

- Class A: Lands where people reside and sleep (such as residential)
- Class B: Lands requiring protection against noise interference with speech (such as commercial/recreational)
- Class C: Lands where economic activities are of such a nature that higher noise levels are anticipated (such as industrial/agricultural).

For the purpose of this analysis, noise-sensitive areas in the project vicinity include Class A and Class C EDNA. Table 3.12-1 summarizes the maximum permissible levels applicable to noise received at noise-sensitive areas (Class A EDNA) and at industrial/agricultural areas (Class C EDNA) from an industrial facility (Class C EDNA).

Table 3.12-1: State of Washington Noise Regulations

Statistical Descriptor	Maximum Permissible Noise Levels (dBA)		
	Class A EDNA Receiver[1]		Class C EDNA Receiver [2]
	Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)	Anytime
L_{eq}	60	50	70
L_{25}	65	55	75
$L_{16.7}$	70	60	80
$L_{2.5}$	75	65	85

Source: WAC 173-60

1 Term used for locations where noise may affect frequent human activities.

2 Standard applies at the property line of the receiving property.

The following are exempted from the limits presented in Table 3.12-1 (per 173-60-050 WAC):

- Construction noise (including blasting) between the hours of 7 a.m. and 10 p.m.
- Motor vehicles when regulated by 173-62 WAC (Motor Vehicle Noise Performance Standards for vehicles operated on public highways).
- Motor vehicles operated off public highways, except when such noise affects residential receivers.

Note that 173-60-50(6) WAC states, "Nothing in these exemptions is intended to preclude the Department [of Ecology] from requiring installation of the best available noise abatement technology consistent with economic feasibility."

There are no state or Kittitas County regulatory limits for allowable increases above background noise levels caused by industrial projects. However, with regard to increases in A-weighted noise levels, listed below are definitions of how noise can be perceived (Kryter 1970).

- Except in carefully controlled laboratory experiments, the human ear cannot perceive a change of 1 dBA.
- Outside the laboratory, a 3-dBA change is considered a just-perceivable difference.

- A change in level of at least 5 dBA is required before any noticeable change in community response can be expected.
- A 10-dBA change is subjectively heard as approximately a doubling in loudness and would likely cause an adverse community response.

Noise Study Methodology

The study area for the KVWPP noise impact analysis included all areas where residents have the potential to hear construction or operational noise from the project.

The effects of noise on people fall into three general categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction;
- Interference with such activities as speech, sleep, and learning; and
- Physiological effects such as startling and hearing loss.

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants may experience noise effects in the third category. There is no completely satisfactory way to measure the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily a result of the wide variation in individual thresholds of annoyance and adjustment to noise. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it with the existing or ambient environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual (California Energy Commission [CEC] 2001a).

Table 3.12-2: Sound Pressure Levels of Representative Sounds and Noises

Source	Decibels	Description
Large rocket engine (nearby)	180	
Jet takeoff (nearby)	150	
Pneumatic riveter	130	
Jet takeoff (60 meters)	120	Pain threshold
Construction noise (3 meters)	110	
Subway train	100	
Heavy truck (15 meters), and Niagara Falls	90	Constant exposure endangers hearing
Average factory	80	
Busy traffic	70	
Normal conversation (1 meter)	60	
Quiet office	50	Quiet
Library	40	
Soft whisper (5 meters)	30	Very quiet
Rustling leaves	20	
Normal breathing	10	Barely audible
Hearing threshold	0	

Source: Tipler 1976

The KVWPP noise analysis was based on noise level measurements taken in the field, vendor-supplied noise data associated with the 1.5 MW wind turbines proposed for this project (under the middle scenario), and computer modeling of the turbine strings using the L_{eq} descriptor (see Operations and Maintenance Impacts, below, for further discussion of noise modeling).

Project Area Land Uses and Noise Sources

The project would be located in mostly undeveloped hilly terrain in a rural area with low population density. There are approximately 60 residential structures within 1 mile of the proposed wind turbine strings. Distances range from approximately 790 to 3,230 feet from the closest wind turbine. Figures presented in Appendix D (Noise) show the location of the proposed wind turbines, residences, and property lines. The primary source of noise in the project area is wind and vehicular traffic along US 97 that bisects the project site.

Noise Measurements and Ambient Noise Levels

Ambient (background) noise is defined as the total of all noise in a system or situation, excluding the sound source of interest (USDOT and FHWA 1980). Because the project area and general vicinity are rural and sparsely populated, background noise levels at locations distant from traveled roadways are relatively low. Ambient noise level measurements were measured at three separate locations (referred to as Locations A, B, and C) to describe the existing noise environment and to identify major noise sources in the project area (Figure 3.12-1). Reference wind speeds also were measured at the monitoring locations. Noise measurements were taken between December 1 through 14, 2002. The results of noise measurements at the three monitoring locations are described in further detail below. (See Appendix D for graphics illustrating the results of background noise measurements.)

Location A

Noise measurement Location A is located along Bettas Road, west of proposed turbine string F (see Figure 3.12-1). Ambient hourly L_{eq} noise levels at Location A, measured between December 1 through December 12, 2002, ranged from below 20 dBA to the upper 40s dBA, with an approximate average over the 12-day monitoring period in the mid-40s dBA. Location A followed a common trend, with noise levels decreasing at night and increasing during the day. Wind speeds at this measurement location were always below 10 mph.

Location B

Noise measurement Location B is located along US 97, just south of this roadway's intersection with Bettas Road (see Figure 3.12-1). Ambient hourly L_{eq} noise levels at Location B, measured between December 5 through December 14, 2002, ranged from the low 40s dBA to the mid-60s dBA, with an approximate average over the 10-day monitoring period in the mid-50s dBA. Similar to Location A, Location B followed the same common trend, with noise levels decreasing at night and increasing during the day. Wind speeds at the measurement location were always below 10 mph.

Figure 3.12-1

Location C

Noise measurement Location C is located between proposed turbine strings I and J in the eastern portion of the project area (see Figure 3.12-1). Ambient hourly L_{eq} noise levels at Location C, measured from December 1 through December 12, 2002, ranged from the low 20s dBA to the mid-40s dBA, with an approximate average over the 12-day monitoring period in the upper 30s dBA. Similar to Locations A and B, Location C followed the same common trend, with noise levels decreasing at night and increasing during the day. Wind speeds at the measurement location were not available during the monitoring period because of lack of equipment.

3.12.2 Impacts of Proposed Action

This section evaluates potential noise impacts that could result from construction and operation of the proposed project. Direct impacts would occur if noise levels exceed WAC criteria for maximum permissible noise levels for a particular receptor or land use. Indirect impacts are not anticipated because the project is not expected to substantially induce regional growth to the extent that would result in significant changes to off-site noise. Table 3.12-3 summarizes potential noise impacts under the three project scenarios.

Table 3.12-3: Summary of Potential Noise Impacts

	82 Turbines/3 MW (Lower End Scenario)	121 Turbines/1.5 MW (Middle Scenario)	150 Turbines/1.3 MW (Upper End Scenario)
Construction Impacts			
Noise generated by construction equipment	Same as middle scenario	See EIS Table 2-4 for list of construction equipment	Same as middle scenario
Blasting noise/conflicts with nearby residential land use	Up to 164 blasts for foundation construction	Up to 242 blasts for foundation construction	Up to 300 blasts for foundation construction
Noise generated by construction traffic	330 PM peak-hour trips (Total of 26,730 heavy truck trips with gravel import)	311 PM peak-hour trips (Total of 23,633 heavy truck trips with gravel import)	315 PM peak-hour trips (Total of 24,238 heavy truck trips with gravel import)
Operations and Maintenance Impacts			
Noise generated by wind turbines	Within regulatory limits	Within regulatory limits	Within regulatory limits
Noise generated by high-voltage transmission lines	Within regulatory limits	Within regulatory limits	Within regulatory limits
Noise generated by traffic	Same as middle scenario	24-28 trips daily; no substantial adverse noise effect	36-40 trips daily; no substantial adverse noise effect
Vibration effects	None	None	None
Decommissioning Impacts			
	Similar in type but shorter in duration compared to those anticipated for the construction phase	Similar in type but shorter in duration compared to those anticipated for the construction phase	Similar in type but shorter in duration compared to those anticipated for the construction phase

Source: Sagebrush Power Partners LLC 2003a, c, f.

Construction Impacts

During the construction phase of the proposed project, noise from construction activities would add to the noise environment in the immediate area. Construction activities would be temporary in nature.

Construction Equipment Noise

Residences in the vicinity of the project site could be exposed to moderate to high levels of construction noise associated with grading and earthmoving activities, hauling of materials, building of structures, and construction of turbines towers. Project construction would require approximately the same type, number, and duration of equipment regardless of whether 82 units of large-size turbines (lower end scenario) or 150 units of small wind turbines (upper end scenario) are built (Sagebrush Power Partners LLC 2003f). However, the number of truck trips associated with construction would vary depending on the project scenario (see the discussion of Construction Traffic Noise, below).

WAC 173-60-050 specifically exempts construction activity noise impacts to Class A (residential) properties during daytime hours (between 7 a.m. and 10 p.m.). Construction noise limits are less restrictive because the noise is temporary. Noise generated by construction equipment is expected to vary, depending on the construction phase. Table 3.12-4 summarizes noise levels produced by construction equipment that would likely be used on the project site at various distances.

Table 3.12-4: Noise Levels from Common Construction Equipment

Construction Equipment	Noise Levels at Various Distances (dBA)			
	50 feet	1,000 feet	2,500 feet	5,000 feet
Bulldozer (250 to 700 horsepower)	88	62	54	43
Front-end loader (6 to 15 cubic yards)	88	62	54	43
Truck (200 to 400 horsepower)	86	60	52	41
Grader (13- to 16-foot blade)	85	59	51	40
Shovel (2 to 5 cubic yards)	84	58	50	39
Portable generators (50 to 200 kilowatts)	84	58	50	39
Mobile crane (11 to 20 tons)	83	57	49	38
Concrete pumps (30 to 150 cubic yards)	81	55	47	36
Tractor (3/4 to 2 cubic yards)	80	54	46	35

Source: Barnes et al. 1977.

Blasting Noise

Nearby residents could potentially be disturbed by the project's temporary construction activities, such as blasting for turbine foundations. Blasting activities are specifically exempt from the noise regulations (WAC 173-69-050). It is estimated that these activities would occur for eight weeks during the foundation excavation phase of construction. Due to rocky site

conditions, it is anticipated that most wind turbine foundations would require one to two blasts (depending on which one of the three scenarios are built) each over the eight-week construction period (Sagebrush Power Partners LLC 2003a, Section 4.1.1.4.1). Blasting would take place in the daytime during the spring, summer, or fall season. This temporary noise impact would be greatest under the upper end scenario, with up to 300 blasts, because it would require constructing the largest number of wind turbines. (See Chapter 2 of this EIS for further details.) Conversely, the potential noise conflicts with nearby sensitive land uses would be the least under the lower end scenario, with as few as 82 blasts, because it would require constructing the smallest number of wind turbines.

The closest residential structure under the middle scenario is approximately 790 feet from the nearest turbine (H23) (Genson property). However, the majority of structures are located from 1,000 and 3,200 feet from the closest wind turbine (Table 3.12-5). Due to the intermittent and temporary nature of proposed construction activities and the distance of the project site from residents, noise from these activities would not substantially impair residential land uses.

Construction Traffic Noise

Construction vehicles traveling on local roadways and other nearby roads would temporarily increase noise levels. The number of truck trips associated with construction would vary depending on the project scenario. This potential noise impact would be greatest under the lower end scenario because it would result in the greatest number of PM peak-hour trips and total heavy-duty truck trips. For example, if gravel has to be hauled in from an offsite location other than the quarry just north of turbine F1 during project construction, the total number of heavy-duty truck trips would range from approximately 23,600 trips under the middle scenario to approximately 26,730 trips under the lower end scenario. (See Section 3.10, Transportation, for further discussion of construction-generated traffic impacts.) However, this would be temporary and is not anticipated to be an adverse impact.

Operations and Maintenance Impacts

Wind Turbine Noise

The proposed wind turbines could potentially operate 24 hours per day during windy periods, and not at all when winds are calmer. Although the exact turbine model to be used for the proposed project scenario has not been determined, representative values for the type of equipment being considered for the project have been used for this analysis. The selected turbines are expected to be warranted by the manufacturer not to exceed a maximum sound pressure level of 103 dBA with a wind speed of 18 mph at 33 feet from the base of the tower in accordance with the protocol established in International Electrotechnical Commission (IEC) 61400. This is approximately equivalent to a sound pressure level of 72 dBA at 50 feet from the turbine. However, a sound pressure level between 98 and 108 dBA is representative of the range of noise test data for all turbines under consideration for the proposed project (Sagebrush Power Partners LLC 2003f).

Table 3.12-5: Predicted Noise Levels in KVWPP Area

Township	Sect	Parcel Owner[1]	Distance from Structure to Turbine (feet)[2]	Nearest Turbine	Map I.D.[3]	Approx. Noise Level at Structure (dBA)[4] EDNA Class A	Distance from Property Line to Turbine (feet)	Approx. Noise Level at Property Line (dBA)[5] EDNA Class C	Nearest Turbine
T19N R17E	1	Brooke	N/A				1,207	40 - 45	H3
T19N R17E	1	L. Gerean	1,338	H1	59	40 - 45	944	45 - 50	H2
T19N R17E	1	Meyer	N/A				732	45 - 50	H1
T19N R17E	1	T. Gerean	804	H1	58	46	692	45 - 50	H1
T19N R17E	2	Burdyshaw	N/A				144	50 - 55	H6
T19N R17E	2	Burdyshaw	N/A				143	50 - 55	H6
T19N R17E	2	Mathias	N/A				601	45 - 50	H5
T19N R17E	2	S. Fossett	2,376	H4	55	35 - 40	1,063	45 - 50	H4
T19N R17E	2	Sambrano	N/A				253	50 - 55	H7
T19N R17E	3	P. Burke	N/A				180	50 - 55	G8
T19N R17E	4	David Archambeau	2,835	G12	42	40 - 45	1,902	40 - 45	G12
T19N R17E	4	James Stewart	N/A				2,856	35 - 40	F2
T19N R17E	4	Rainbow Ranch	2,519	G10	41	40 - 45	2,274	40 - 45	G10
T19N R17E	9	Anthony	1,662	F6	43	40 - 45	1,491	35 - 40	F6
T19N R17E	9	David Archambeau	N/A				193	50 - 55	F4
T19N R17E	9	Estes	N/A				1,659	40 - 45	D1
T19N R17E	9	Jackson	N/A				2,679	35 - 40	D1
T19N R17E	9	L. Schaller	N/A				2,325	40 - 45	F6
T19N R17E	9	Martin Rand	N/A				1,361	45 - 50	F11
T19N R17E	9	North	2,610	D1	150	35 - 40	2,095	35 - 40	D1
T19N R17E	9	Robertson	1,325	D1	555	42	875	40 - 45	D1
T19N R17E	9	Sean Taylor	1,132	D1	45	40 - 45	410	45 - 50	D1
T19N R17E	9	Slim Jorgensen	N/A				2,841	35 - 40	F2
T19N R17E	9	T. Gaskill	1,995	F7	44	40 - 45	1,795	40 - 45	F6
T19N R17E	9	WSDOT	N/A				1,531	40 - 45	F7
T19N R17E	9	Zeller	N/A				2,767	35 - 40	D1
T19N R17E	11	N. Andrew[6]	1,028	H13	50	49			

Source: Sagebrush Power Partners LLC 2003c, as amended by Sagebrush Power Partners LLC 2003f, h.

1 Property owners in the KVWPP area where turbines are proposed but no structure is present that have not been included in this table include: L. Tritt, Pautzke Bait Co., C. Thomas, D. and M. Green, J. Majors, Cascade Field & Stream, K. Krogstad, and Los Abuelos, Inc.

2 N/A indicates that aerial photography does not show a structure on the property.

3 See noise figures in Appendix D for corresponding Map I.D.

4 The EDNA classification for noise levels at structures is Class A. The maximum permissible daytime noise level at a Class A receptor is an Leq of 60 dBA, and the maximum permissible nighttime noise level at a Class A receptor is an Leq of 50 dBA. Approximate noise levels are presented at a predicted specific level (as opposed to a range) for those parcel owners that approach the 50 dBA nighttime noise threshold.

5 The EDNA classification for noise levels at property lines is Class C. The maximum permissible noise level (daytime or nighttime) at a Class C receptor is an Leq of 70 dBA.

6 In general, noise levels at property lines were not estimated for property owners with signed wind option agreements with the Applicant.

Table 3.12-5: Continued

Township	Sect	Parcel Owner[1]	Distance from Structure to Turbine (feet)[2]	Nearest Turbine	Map I.D.[3]	Approx. Noise Level at Structure (dBA)[4] EDNA Class A	Distance from Property Line to Turbine (feet)	Approx. Noise Level at Property Line (dBA)[5] EDNA Class C	Nearest Turbine
T19N R17E	12	Gagon	2,588	J1	75	35 - 40	141	50 - 55	J1
T19N R17E	12	Gorski	N/A				490	45 - 50	J1
T19N R17E	12	Pentz	N/A				559	50 - 55	J2
T19N R17E	12	Robert Best	N/A				1,809	40 - 45	J1
T19N R17E	13	A. Schwab	2,036	J12	215	40 - 45	483	50 - 55	J12
T19N R17E	13	E. Garrett	N/A				316	50 - 55	J11
T19N R17E	13	Gallagher	N/A				1,286	45 - 50	J5
T19N R17E	13	Gallagher/Steinman	N/A				342	50 - 55	J9
T19N R17E	13	J. Kuhn	N/A				151	50 - 55	J7
T19N R17E	13	J. Sherman	N/A				838	45 - 50	J14
T19N R17E	13	J. Vlasic	N/A				335	50 - 55	J8
T19N R17E	14	M. Genson[6]	788	H23	49	48			
T19N R17E	14	Nelson	1,290	J10	417	48	164	50 - 55	I16
T19N R17E	14	Steinman/Geisick	1,055	J15	117	46	583	45 - 50	I19
T19N R17E	17	Nature Conservancy	N/A				809	40 - 45	A1
T19N R17E	17	Swauk Valley Ranch	N/A				2,820	30 - 35	A1
T19N R17E	20	BLM	N/A				2,032	35 - 40	A2
T19N R17E	21	Holmquist	N/A				1,262	45 - 50	B7
T19N R17E	21	Swauk Valley Ranch	N/A				293	50 - 55	A3
T19N R17E	23	Barkl	2,331	E5	418	35 - 40	930	40 - 45	E5
T19N R17E	23	Bowman	N/A				1,335	40 - 45	I21
T19N R17E	23	Burt	2,530	E5	83	35 - 40	1,383	40 - 45	E5
T19N R17E	23	Burt	2,344	E5	84	35 - 40	1,383	40 - 45	E5
T19N R17E	23	Burt	2,191	E5	85	35 - 40	1,383	40 - 45	E5
T19N R17E	23	Darrow	2,269	E5	86	35 - 40	1,808	35 - 40	E5
T19N R17E	23	Engelstad	2,692	E5	94	35 - 40	1,565	40 - 45	E5
T19N R17E	23	Gordon	N/A				2,929	35 - 40	E5

Source: Sagebrush Power Partners LLC 2003c, as amended by Sagebrush Power Partners LLC 2003f, h.

1 Property owners in the KVWPP area where turbines are proposed but no structure is present that have not been included in this table include: L. Tritt, Pautzke Bait Co., C. Thomas, D. and M. Green, J. Majors, Cascade Field & Stream, K. Krogstad, and Los Abuelos, Inc.

2 N/A indicates that aerial photography does not show a structure on the property.

3 See noise figures in Appendix D for corresponding Map I.D.

4 The EDNA classification for noise levels at structures is Class A. The maximum permissible daytime noise level at a Class A receptor is an Leq of 60 dBA, and the maximum permissible nighttime noise level at a Class A receptor is an Leq of 50 dBA. Approximate noise levels are presented at a predicted specific level (as opposed to a range) for those parcel owners that approach the 50 dBA nighttime noise threshold.

5 The EDNA classification for noise levels at property lines is Class C. The maximum permissible noise level (daytime or nighttime) at a Class C receptor is an Leq of 70 dBA.

6 In general, noise levels at property lines were not estimated for property owners with signed wind option agreements with the Applicant.

Table 3.12-5: Continued

Township	Sect	Parcel Owner[1]	Distance from Structure to Turbine (feet)[2]	Nearest Turbine	Map I.D.[3]	Approx. Noise Level at Structure (dBA)[4] EDNA Class A	Distance from Property Line to Turbine (feet)	Approx. Noise Level at Property Line (dBA)[5] EDNA Class C	Nearest Turbine
T19N R17E	23	Higginbotham	2,757	E5	89	35 - 40	2,567	35 - 40	E5
T19N R17E	23	Higginbotham	2,885	E5	90	35 - 40	2,567	35 - 40	E5
T19N R17E	23	Holister	N/A				145	50 - 55	J15
T19N R17E	23	J. Campbell	N/A				362	45 - 50	E5
T19N R17E	23	Kimbler	N/A				2,809	35 - 40	J15
T19N R17E	23	M. Campbell	1,841	E5	82	40 - 45	362	45 - 50	E5
T19N R17E	23	Millett	N/A				1,006	45 - 50	E4
T19N R17E	23	Millett	N/A				1,563	40 - 45	I21
T19N R17E	23	Murphy	N/A				2,818	35 - 40	J15
T19N R17E	23	Price	1,968	J15	80	35 - 40	1,275	40 - 45	J15
T19N R17E	23	R. Wines	N/A				1,970	40 - 45	I21
T19N R17E	23	R. Wines/L. Snover	2,479	J15	81	35 - 40	855	40 - 45	I21
T19N R17E	23	Schults	2,524	E5	87	35 - 40	2,218	35 - 40	E5
T19N R17E	23	Schults	2,401	E5	88	35 - 40	2,218	35 - 40	E5
T19N R17E	23	Schults	N/A				360	45 - 50	E5
T19N R17E	23	Tate	N/A				2,685	35 - 40	E5
T19N R17E	23	Winkle	2,882	E5	93	35 - 40	2,300	35 - 40	E5
T19N R17E	23	Zellmer	1,797	E3	48	40 - 45	1,350	40 - 45	I21
T19N R17E	24	DNR	N/A				1,039	45 - 50	J15
T19N R17E	26	Clayburn	3,230	C5	100	35 - 40	2,264	35 - 40	C5
T19N R17E	26	Engelstad	N/A				2,247	35 - 40	C4
T19N R17E	26	Heistand	N/A				1,740	30 - 35	C5
T19N R17E	26	Jones	N/A				2,050	35 - 40	C4
T19N R17E	26	KRD (Canal)	N/A				926	40 - 45	C5
T19N R17E	26	Poulin	N/A				935	40 - 45	C5
T19N R17E	26	Ptaszynski	2,265	C5	101	35 - 40	1,472	35 - 40	C5
T19N R17E	26	Reilley	N/A				1,884	35 - 40	C4

Source: Sagebrush Power Partners LLC 2003c, as amended by Sagebrush Power Partners LLC 2003f, h.

1 Property owners in the KVWPP area where turbines are proposed but no structure is present that have not been included in this table include: L. Tritt, Pautzke Bait Co., C. Thomas, D. and M. Green, J. Majors, Cascade Field & Stream, K. Krogstad, and Los Abuelos, Inc.

2 N/A indicates that aerial photography does not show a structure on the property.

3 See noise figures in Appendix D for corresponding Map I.D.

4 The EDNA classification for noise levels at structures is Class A. The maximum permissible daytime noise level at a Class A receptor is an Leq of 60 dBA, and the maximum permissible nighttime noise level at a Class A receptor is an Leq of 50 dBA. Approximate noise levels are presented at a predicted specific level (as opposed to a range) for those parcel owners that approach the 50 dBA nighttime noise threshold.

5 The EDNA classification for noise levels at property lines is Class C. The maximum permissible noise level (daytime or nighttime) at a Class C receptor is an Leq of 70 dBA.

6 In general, noise levels at property lines were not estimated for property owners with signed wind option agreements with the Applicant.

Table 3.12-5: Continued

Township	Sect	Parcel Owner[1]	Distance from Structure to Turbine (feet)[2]	Nearest Turbine	Map I.D.[3]	Approx. Noise Level at Structure (dBA)[4] EDNA Class A	Distance from Property Line to Turbine (feet)	Approx. Noise Level at Property Line (dBA)[5] EDNA Class C	Nearest Turbine
T19N R17E	26	Six-Ten Investment	N/A				977	40 - 45	C5
T19N R17E	26	Tate	3,000	C5	99	35 - 40	2,685	35 - 40	E5
T19N R17E	27	Basterrechea	N/A				2,289	35 - 40	B11
T19N R17E	27	KRD (Canal)	N/A				200	50 - 55	C5 & B12
T19N R17E	27	Neuman	N/A				2,268	35 - 40	B11
T19N R17E	27	Pearson	N/A				733	40 - 45	B12
T19N R17E	28	George	N/A				2,283	35 - 40	B11
T19N R17E	28	Holmquist	N/A				1,733	40 - 45	B7
T19N R17E	28	Neuman	N/A				2,751	35 - 40	B11
T19N R17E	28	Pearson	1,976	B9	47	40 - 45	1,197	40 - 45	B9
T19N R17E	28	Pearson	1,897	B11	118	35 - 40	1,197	40 - 45	B9
T19N R17E	28	Schoeber	N/A				466	45 - 50	B7
T19N R17E	28	Tonseth	N/A				2,068	30 - 35	B8
T19N R17E	34	Buck	N/A				2,267	30 - 35	B12
T19N R17E	34	C. Wright	N/A				2,304	30 - 35	B12
T19N R17E	34	Der Yuen	N/A				1,918	35 - 40	B12
T19N R17E	34	Fonken	N/A				2,789	30 - 35	B12
T19N R17E	34	K. Smith	N/A				2,566	30 - 35	B12
T19N R17E	34	Kittitas Co Tax Deed	N/A				2,579	30 - 35	B12
T19N R17E	34	Levin	N/A				2,886	30 - 35	B12
T19N R17E	34	Pollock	N/A				1,848	35 - 40	B12
T19N R17E	34	Schober	N/A				1,728	35 - 40	B12
T19N R17E	34	WSDOT	N/A				2,206	30 - 35	B12
T19N R17E	34	Zeigler	N/A				2,623	30 - 35	B12
T19N R17E	35	Ellensburg Ranches	N/A				2,813	30 - 35	C5
T19N R17E	35	Gerald Boose	N/A				2,579	35 - 40	C5
T19N R18E	7	C. Thompson	N/A				2,769	35 - 40	J1

Source: Sagebrush Power Partners LLC 2003c, as amended by Sagebrush Power Partners LLC 2003f, h.

1 Property owners in the KVWPP area where turbines are proposed but no structure is present that have not been included in this table include: L. Tritt, Pautzke Bait Co., C. Thomas, D. and M. Green, J. Majors, Cascade Field & Stream, K. Krogstad, and Los Abuelos, Inc.

2 N/A indicates that aerial photography does not show a structure on the property.

3 See noise figures in Appendix D for corresponding Map I.D.

4 The EDNA classification for noise levels at structures is Class A. The maximum permissible daytime noise level at a Class A receptor is an Leq of 60 dBA, and the maximum permissible nighttime noise level at a Class A receptor is an Leq of 50 dBA. Approximate noise levels are presented at a predicted specific level (as opposed to a range) for those parcel owners that approach the 50 dBA nighttime noise threshold.

5 The EDNA classification for noise levels at property lines is Class C. The maximum permissible noise level (daytime or nighttime) at a Class C receptor is an Leq of 70 dBA.

6 In general, noise levels at property lines were not estimated for property owners with signed wind option agreements with the Applicant.

Table 3.12-5: Continued

Township	Sect	Parcel Owner[1]	Distance from Structure to Turbine (feet)[2]	Nearest Turbine	Map I.D.[3]	Approx. Noise Level at Structure (dBA)[4] EDNA Class A	Distance from Property Line to Turbine (feet)	Approx. Noise Level at Property Line (dBA)[5] EDNA Class C	Nearest Turbine
T19N R18E	7	Lockhart	N/A				2,925	35 - 40	J1
T19N R18E	7	Szuba	N/A				2,778	35 - 40	J1
T20N R17E	34	P. Burke	2,795	G1	151	35 - 40	546	45 - 50	G2
T20N R17E	34	P. Burke	2,592	G1	152	35 - 40	546	45 - 50	G2
T20N R17E	34	U.S. Timber	N/A				151	50 - 55	G1
T20N R17E	35	C. Mannahan	N/A				2,618	35 - 40	H1
T20N R17E	35	Hampton	N/A				2,680	35 - 40	G1
T20N R17E	35	J. Moery	2,499	H1	56	35 - 40	2,147	30 - 35	H1
T20N R17E	35	J. Wilson	3,034	G1	221	35 - 40	2,092	40 - 45	G1
T20N R17E	35	Korthanke	2,521	H1	27	35 - 40	2,239	35 - 40	H1
T20N R17E	35	M. Dickerson	N/A				2,489	35 - 40	H1
T20N R17E	35	R. Weiler	N/A				2,117	40 - 45	H1
T20N R17E	35	S. Oslund	1,115	H1	216	40 - 45	821	40 - 45	H1
T20N R17E	35	S. Oslund	N/A				1,033	45 - 50	H1
T20N R17E	35	Sandall	2,747	G1	13	35 - 40	2,089	35 - 40	G1
T20N R17E	35	Slape	N/A				2,891	35 - 40	H1
T20N R17E	35	W. Flowers	N/A				2,546	35 - 40	G1
T20N R17E	36	DNR	N/A				1,082	40 - 45	H1

Source: Sagebrush Power Partners LLC 2003c, as amended by Sagebrush Power Partners LLC 2003f, h.

1 Property owners in the KVWPP area where turbines are proposed but no structure is present that have not been included in this table include: L. Tritt, Pautzke Bait Co., C. Thomas, D. and M. Green, J. Majors, Cascade Field & Stream, K. Krogstad, and Los Abuelos, Inc.

2 N/A indicates that aerial photography does not show a structure on the property.

3 See noise figures in Appendix D for corresponding Map I.D.

4 The EDNA classification for noise levels at structures is Class A. The maximum permissible daytime noise level at a Class A receptor is an Leq of 60 dBA, and the maximum permissible nighttime noise level at a Class A receptor is an Leq of 50 dBA. Approximate noise levels are presented at a predicted specific level (as opposed to a range) for those parcel owners that approach the 50 dBA nighttime noise threshold.

5 The EDNA classification for noise levels at property lines is Class C. The maximum permissible noise level (daytime or nighttime) at a Class C receptor is an Leq of 70 dBA.

6 In general, noise levels at property lines were not estimated for property owners with signed wind option agreements with the Applicant.

Modeled Noise Levels

To collect meaningful noise data for a wind turbine project, the wind must be moving fast enough to at least engage the wind turbine blades (between 7 to 10 mph). When these windy conditions exist, they often result in significant wind noise on the microphone that adversely affects the quality of the noise data collected. Accurate noise measurements require high enough wind speeds at the turbine to generate noise and low enough wind speeds at the measurement location to avoid wind-induced microphone noise. Therefore, although background noise measurements were collected (as described above in the Affected Environment section), the project's noise impact analysis is based on manufacturers' noise emissions data available for the proposed 1.5-MW wind turbine supplied by the vendor and internationally recognized noise modeling standards. The procedures for determining sound pressure levels from wind turbines are defined in IEC 61400 Wind Turbine Generator Systems Part 11: Acoustic Noise Measurement Techniques (Reference Number: IEC 61400-11:1998[E]). The measurement technique outlines procedures to determine corrections for background noise, apparent sound pressure level, and wind speed dependence (Sagebrush Power Partners LLC 2003c).

Noise modeling was based on a turbine sound pressure level of approximately 103 dBA. In general, if the sound pressure level decreases by 5 dBA (103 down to 98 dBA) the resulting sound pressure levels at the receivers would also decrease by approximately 5 dBA. The shape of the sound pressure level contours would not change. However, their value would be adjusted downward by 5 dBA (i.e., the current 45 dBA contour would be relabeled as the 40 dBA contour). Similarly, if the turbine sound pressure level increased, the resulting sound levels and contours would be adjusted upward. A sound pressure level between 98 and 108 dBA is representative of the range of turbine noise test data for all the turbines under consideration for the proposed project (Sagebrush Power Partners LLC 2003f). Therefore, the estimated noise levels at structures and property lines in Table 3.12-5 could be +/-5 dBA, which could in turn exceed regulatory thresholds.

Middle Scenario

Daytime noise levels for residential structures (Class A EDNA) are required by 173-60 WAC not to exceed 60 dBA, while nighttime levels are not to exceed 50 dBA. Table 3.12-5 identifies properties in the project area located within 3,000 feet of a proposed turbine, the distance between structures (if any) to the closest wind turbine, the distance between property lines and the closest wind turbine, and the predicted noise level at structures and property lines with an assumed wind speed of 18 mph. Figures illustrating predicted noise contours in the project area in relation to existing structures and property lines are contained in Appendix D. As summarized in Table 3.12-5, the middle scenario is anticipated to result in noise levels ranging from 35 to 49 dBA. The results indicate that noise levels would be below the most restrictive nighttime regulation of 50 dBA. Therefore, no significant noise impacts to Class A properties are anticipated during the daytime or nighttime operations of the proposed project. However, regulatory thresholds might be exceeded if the sound pressure level for the turbine selected for construction is greater than the modeled scenario. See Section 3.12.4 for recommended mitigation measures to address this issue.

Noise levels for Class C EDNA (industrial/agricultural) are not to exceed 70 dBA at property lines. Noise levels at the property lines of Class C parcels within the project area range from a minimum of 35 dBA to a maximum of 55 dBA (see Table 3.12-5) for the middle scenario. Because the predicted noise level is below the threshold established for Class C properties by the WAC, no significant noise impacts are anticipated.

Upper and Lower End Scenarios

Section 2.2.1, Project Overview, in Chapter 2, Proposed Action and Alternatives describes the three project scenarios. Wind turbine heights could range from a low of 260 feet under the upper end scenario to a high of 410 feet under the lower end scenario. However, the height of the wind turbine has very little bearing on the noise level at the analyzed receivers or property lines. For the three project scenarios under consideration, no measurable noise difference is anticipated. Typically the distance between larger turbines (lower end scenario, up to 82 wind turbines constructed) is greater than between those of smaller turbines (upper end scenario, up to 150 wind turbines constructed). This is because the lower end scenario would have fewer turbines per string than the upper end scenario. It is anticipated that noise levels from either scenario (upper end versus lower end) would be very similar to the modeled middle scenario (see Appendix D) in which distances from a receiver to the closest wind turbine would dictate noise levels (Sagebrush Power Partners LLC 2003f).

Increase in Ambient Background Noise Levels

Ambient background noise levels were not measured at specific project area receptors. However, general observations can be made based on available data. As described above in the Affected Environment section, ambient background noise levels were measured over several days at three locations within the project area. Throughout the measurement period, wind speed at Location A and B measurement sites never exceeded 10 mph. Noise levels varied throughout the day and for the most part depended upon wind speeds.

Predicted noise levels during project operation at the residences closest to noise measurement Location A (owners Anthony and Gaskill) ranged between 40 to 45 dBA. This corresponds to the ambient average L_{eq} dBA measured in the mid-40s. Predicted operational noise levels at the two structures closest to noise measurement Location B (owners Zellmer and Genson) resulted in noise levels ranging between 40 to 48 dBA. These are lower than the ambient noise levels in this area with an L_{eq} average measured in the low to mid-50s dBA. Based on this comparison, the anticipated difference between the measured ambient and predicted noise levels at these receptors should not be a perceived as a noticeable increase. Location C had an average L_{eq} dBA over the 12-day monitoring period in the mid- to upper 30s. Predicted noise levels during project operations at the residences closest to this measurement location (owners Nelson and Steinman/Geisick) ranged between 46 to 48 dBA. Therefore, the anticipated difference between the measured ambient and predicted noise levels in this part of the project area could be subjectively heard as approximately a doubling in loudness and would likely cause an adverse community response.

As stated in Section 3.12.1 above, there are no state or Kittitas County regulatory limits regarding an allowable increase above background noise levels caused by industrial projects. Noise modeling results indicate that project operations would not exceed regulatory threshold levels. Furthermore, the Applicant has entered into wind option agreements with landowners on whose property wind power facilities are proposed. These agreements contain provisions for generally accepting the impacts (including noise effects) of having these turbines on their property (Taylor, pers. comm., 2003). However, lack of a regulatory standard does not preclude the possibility that changes in background noise levels could be perceived as adverse depending on the magnitude of that change and the nature of the receptor. Given the variation in the size and location of proposed turbines under the three project scenarios, distances between turbines and receptors, and effects of wind speed, perceived changes in noise levels throughout the project area would be variable, and could range from no perceived effect to an adverse effect. Given the level of concern raised by the public about the potential effects of operational noise and the variability of final turbine sizes and locations, mitigation measures are recommended below to ensure that project operations comply with applicable regulatory thresholds to protect nearby receptors from adverse noise effects.

High Voltage Transmission Line Noise

Noise associated with operation of proposed high-voltage transmission lines would be corona noise during infrequent wet or foggy weather. Corona noise is a low-frequency hum (120 hertz) and crackling caused by partial breakdown of the insulting properties of air surrounding the electric conductor of the transmission line (Bonneville and EFSEC 2002). The high-voltage transmission lines associated with the project would be short (less than 200 feet long) and connect the proposed substations to existing high-voltage overhead transmission lines (either Bonneville or PSE). Audible noise from the transmission lines would comply with the Bonneville Power Administration's limits, namely an L_{50} level of 50 dBA at the edge of the right-of-way (Perry 1982). There are no existing dwellings within the right-of-way of the transmission lines. Therefore, corona noise is not expected to pose a significant noise impact.

Traffic Noise

Project operations would generate a small amount of traffic on local area roadways as workers commute to and from the O&M facility. The primary access route to the O&M facility would be US 97. Traffic noise levels depend on volume, speed, percentage of trucks, topography, vegetation, and distance from the roadway to the receptor. For example, roadway noise levels typically decrease 3 dB over hard ground (concrete or pavement) and 4.5 dB over soft ground (grass) for every doubled distance between the source and the receptor. Vehicular noise is a combination of noises from the engine, exhaust, and tires. It is estimated that daily worker trips to and from the O&M facility would range from between 24-28 trips under the lower end and middle scenarios, to 36-40 trips under the upper end scenario (see Section 3.10, Transportation). Given the magnitude of projected operational trips, this minor increase in traffic along US 97 would not generate substantial adverse noise effects.

Traffic between the O&M facility and individual turbines along project access roads would be minimal during operations because scheduled maintenance is generally performed only every six

months on each turbine. This traffic would consist largely of weekly or less frequent trips to turbines in service vehicles for maintenance and repair activities. Therefore, vehicular noise generated along access roads during routine turbine maintenance activities would be infrequent and would not result in substantial adverse noise effects.

Vibration

During the EIS scoping process, the public expressed concern about the potential for project operations to generate and transmit vibration through the ground over considerable distances. Specific concerns ranged from the potential for vibration to disturb residents and wildlife as well as potential adverse effects to local groundwater wells.

Vibration can sometimes occur in connection with combustion turbine installations. Combustion turbines are capable of producing high levels of low-frequency noise. Low-frequency noise can couple with wood frame walls and windows to cause a mild but perceptible vibration. While these sound levels are virtually inaudible, the vibration may cause an adverse reaction (Bonneville and EFSEC 2002).

The Applicant and its consulting team indicate they are not aware of any wind turbine project where ground-borne vibration from an operating wind turbine has adversely affected nearby receptors or uses (Sagebrush Power Partners LLC 2003c). An Internet search by the EIS consultant also failed to identify research, reports, or other information to substantiate this concern. Therefore, it is the independent conclusion of the EIS authors that the proposed project would not result in any significant impacts from ground-borne vibration (Reed, pers. comm., 2003).

Decommissioning Impacts

Decommissioning activities would be similar in type but shorter in duration compared to those anticipated for the construction phase. Noise generated during decommissioning activities would be conducted between 7 a.m. and 10 p.m. No blasting would be required, resulting in lower noise levels than for construction. The same mitigation measures recommended during construction could also be used during the decommissioning phase.

3.12.3 Impacts of No Action Alternative

Under the No Action Alternative, the project would not be constructed or operated, and the environmental impacts described in this section would not occur. The No Action Alternative assumes that future development would comply with existing zoning requirements for the project area, which is zoned Agriculture-20 and Forest and Range. According to the county's zoning code, the Agriculture-20 zone is dominated by farming, ranching, and rural lifestyles, and permitted uses include residential and agriculture and forestry practices. Permitted uses in the Forest and Range zone include logging, mining, quarrying, and agricultural practices, as well as residential uses (Kittitas County 1991).

If the proposed project is not constructed, it is likely that the region's need for power would be addressed by developing a gas-fired combustion turbine. Because constructing and operating a gas-fired combustion turbine is a predictable consequence of not building the project, it is considered a predictable outcome of the No Action Alternative (Bonneville et al. 2002). Both the construction and operational impacts of a gas-fired combustion turbine are more noise-intensive than the proposed wind generation project. Construction impacts from a conventional gas turbine plant can exceed 110 dBA at 100 feet during steam blowdown activities, and operational noise levels can exceed 80 dBA at 100 feet (CEC 2001b). The noise impacts of a gas turbine generator would depend on its location and design. In some settings, it could be considered highly incompatible with the existing environment; however, in the appropriate location, noise impacts could be minor.

3.12.4 Mitigation Measures

Mitigation Measures Proposed by the Applicant

- Substation transformers and high-voltage switching equipment would be specified or designed to comply with the 70 dBA limit at all Class C EDNA property lines and 50 dBA at all Class A EDNA structures (Sagebrush Power Partners LLC 2003c).

Additional Recommended Mitigation Measures

Construction

Although no specific receivers are identified as being adversely affected by construction noise, the following contractor practices are recommended to minimize the effects of construction noise in the project area:

- Implement work-hour controls so that noisy activities occur between 7 a.m. and 10 p.m., which would reduce the impact during sensitive nighttime hours.
- Maintain equipment in good working order and use adequate mufflers and engine enclosures to reduce equipment noise during operation.
- Turn off engines when not in use to eliminate needless engine idle noise.
- Locate stationary equipment away from receiving properties to help reduce the noise through increased distance between source and receiver.
- Coordinate construction vehicle travel to reduce the number of passes by sensitive receivers.
- Schedule noisy activities to occur at the same time since additional sources of noise generally do not add a significant amount of noise.
- In the most severe case of construction noise, use temporary noise barriers or curtains to reduce noise from stationary equipment or activities located near sensitive receivers.

Operations and Maintenance

During EIS scoping, concerns were raised about the effects of the project's operational noise on nearby residents. It was suggested that trees should be planted for property owners to buffer noise impacts. Retaining existing trees and shrubs and planting new vegetation around residences

in the project area would reduce noise annoyance psychologically by removing the noise source from view. However, to actually reduce noise levels, vegetation must completely block the line of sight between the receptor and the wind turbine. In addition, the vegetative buffer must be of sufficient depth to reduce noise. For example, dense woods with a depth of 100 feet would be required to reduce noise by 5 dBA. This kind of sound reduction from intervening landscaping would be expected to occur in the forested, residential establishment northwest of the project site, referred to as "Section 35." However, on the rangeland portions of the site, planting dense landscaping of sufficient depth to reduce noise would require a change in use of adjacent agricultural and residential properties. Therefore, vegetative buffering to reduce noise is not considered to be a reasonable mitigation measure for those properties.

To ensure that noise levels in the project do not exceed regulatory thresholds during project operations, the following mitigation measure is recommended:

- Prior to construction, an acoustical analysis of the final turbine layout should be prepared for all wind turbines to be located within one mile of an existing residence prior to project construction. The analysis should be conducted using noise level data for the final turbine type, size, and layout and would demonstrate compliance with the WAC (173-60). If compliance is not demonstrated, turbines should be relocated or removed, to the extent necessary, so that the project meets applicable regulatory thresholds.

3.12.5 Significant Unavoidable Adverse Impacts

With implementation of the proposed and recommended mitigation measures outlined above, no significant unavoidable adverse impacts from noise associated with constructing, operating, or decommissioning the proposed project would be anticipated.